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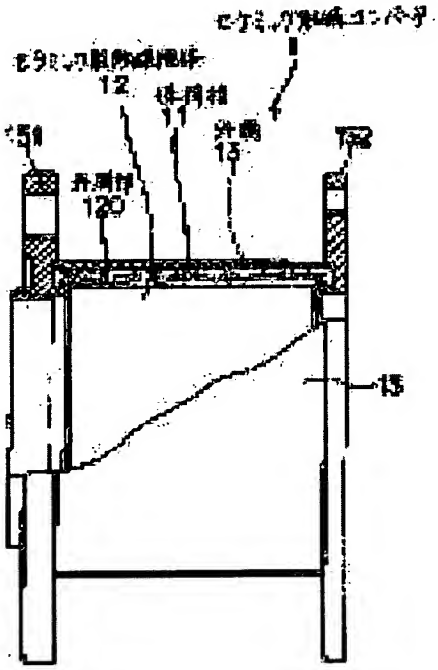
(54) MANUFACTURE OF CERAMIC CATALYST CONVERTER AND CERAMIC CATALYST CONVERTER

(57)Abstract:

PROBLEM TO BE SOLVED: To provide manufacture of a ceramic catalyst converter wherein a catalyst carrier made of ceramic is always stably and reliably held in an outer cylinder and to provide the ceramic catalyst converter.

SOLUTION: In assembly of a catalyst carrier 12 made of ceramic with a holding material 11 located in an outer tube 13 made of a metal, a holding material 11 is mounted on the outer peripheral part 120 of the catalyst carrier 12 made of ceramic, and the holding materials is inserted in an outer tube 13 having an inside diameter slidingly smaller than the outside diameter of the holding material 11 after mounting of the catalyst carrier to produce an assembly. Thereafter, the whole periphery of the assembly is reduced through deformation in a taper-form state of the outer tube 11 until a bearing which the holding material 11 has a increased to a given surface pressure value.



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CLAIMS

[Claim(s)]

[Claim 1] In making maintenance material intervene in a metal outer case, and attaching the catalyst support made from a ceramic, it inserts in the above-mentioned outer case which equips the periphery section of the above-mentioned catalyst support made from a ceramic with the above-mentioned maintenance material, and has a bore a little smaller subsequently than the maintenance material outer diameter after equipping with this. The manufacture approach of the ceramic catalytic converter characterized by carrying out the taper status change form of the above-mentioned outer case, and carrying out perimeter diameter reduction until the above-mentioned maintenance material comes to have predetermined planar pressure for an assembly, and nothing, after that and this assembly.

[Claim 2] The manufacture approach of a ceramic catalytic converter that the taper angle at the time of the taper status change form of the above-mentioned outer case is characterized by being the include angle of 3-30 degrees to the direction of an outer case medial axis in claim 1.

[Claim 3] It is the manufacture approach of the ceramic catalytic converter characterized by the maintenance material of a front with [above-mentioned] a group having the shape of a cylindrical shape of the shape of the shape of a space form between the above-mentioned catalyst support made from a ceramic, and the above-mentioned outer case before diameter reduction, and abbreviation isomorphism in claim 1 or 2.

[Claim 4] It is the manufacture approach of the ceramic catalytic converter characterized by performing diameter reduction of the above-mentioned outer case by spinning in any 1 term of claims 1-3.

[Claim 5] For a front assembly, the above-mentioned spinning is the manufacture approach of the ceramic catalytic converter characterized by extruding with other assemblies followed [in / on claim 4 and / the extrusion process].

[Claim 6] The catalyst support made from a ceramic which has been arranged in an engine exhaust air path and formed the catalyst bed in the cel front face, In the ceramic catalytic converter which consists of the outer case which contains the above-mentioned catalyst support made from a ceramic, the above-mentioned outer case, and maintenance material arranged in the opening between the above-mentioned catalyst support made from a ceramic The above-mentioned maintenance material does not contain the thermal-expansion matter, and it does not carry out a phase transformation in the periphery section temperature of the periphery section of the catalyst support made from a ceramic at the time of exhaust air purification. And the above-mentioned outer case The ceramic catalytic converter characterized by carrying out perimeter diameter reduction through a taper status change form until the above-mentioned maintenance material has predetermined planar pressure after inserting what equipped the above-mentioned catalyst support periphery section made from a ceramic with the above-mentioned maintenance material.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the ceramic catalytic converter arranged in the exhaust air path of engines for cars, such as an automobile.

[0002]

[Description of the Prior Art] Into the exhaust air path of car motor, the ceramic catalytic converter for exhaust gas purification is formed. Conventionally, what the above-mentioned ceramic catalytic converter becomes from the catalyst support made from a ceramic in which the catalyst bed was formed on the cel front face, and the outer case which contains the above-mentioned catalyst support made from a ceramic is known.

[0003] And as the above-mentioned catalyst support made from a ceramic, the cordierite system ceramic (2MgO, 2aluminum2 O3, and 5SiO2) of a low-fever expansion coefficient is used, and there is an operating experience for about ten years in this. Moreover, in the aeration cel front face of the above-mentioned catalyst support made from a ceramic, the catalyst bed which consists of noble metals for changing into a harmless gas or water injurious ingredients, such as CO, HC, NOx, etc. which are contained in the exhaust gas of an automobile engine, such as Pt, Rh, and Pd, is supported.

[0004] By the way, generally the above-mentioned honeycomb support made from a ceramic has low weak tenacity. For this reason, containing the above-mentioned honeycomb support made from a ceramic in a blacking wash and the above-mentioned outer case is proposed by the maintenance material which becomes JP,4-26649,Y from the thermal-expansion nature ceramic mat which mixed thermal-expansion matter, such as a vermiculite and a mica, in the ceramic staple fiber, and it is put in practical use partly.

[0005] However, about maintenance within the outer case of the hot catalyst support made from a ceramic, since degradation advances violently by being put to the hot exhaust gas exceeding 850 degrees C, by the time various above-mentioned thermal-expansion matter can guarantee sufficient dependability, it will not have resulted.

[0006] That is, with degradation of the hot above-mentioned thermal-expansion matter, the maintenance capacity of the catalyst support of the above-mentioned ceramic mat might decline, catalyst support might shake in the outer case by vibration at the time of automobile transit etc., and it might damage.

[0007] Then, as shown in JP,7-77036,A, using heat-resistant and inexpansible ceramic fiber as the above-mentioned maintenance material is proposed. It becomes possible to hold the catalyst support made from a ceramic certainly in an outer case under the hot exhaust gas ambient atmosphere exceeding 850 degrees C by using the above-mentioned ceramic fiber.

[0008]

[Problem(s) to be Solved] However, when the inexpansible ceramic fiber mentioned above is used as maintenance material, there is a possibility that the problem shown below may occur. That is, since the above-mentioned maintenance material is inexpansible, there is almost no change between the volume in ordinary temperature, and the volume in an elevated temperature. However, the path itself expands the above-mentioned outer case by thermal expansion by being put to hot exhaust gas.

[0009] For this reason, in order to apply to an elevated temperature from ordinary temperature and to hold certainly the above-mentioned catalyst support made from a ceramic, it is necessary to take the very large compression width of face of the maintenance material at the time of attachment by the outer case. Consequently, by the "canning method" shown in JP,7-77036,A, there was a possibility that a ceramic catalytic converter might be damaged during engine operation so that it might explain in full detail below.

[0010] That is, there is a possibility that deformation with rapid ceramic fiber may be received by the corner of an outer case during pushing, and this may be damaged in the "pushing method" which pushes in both the maintenance material that consists of

catalyst support made from a ceramic and ceramic fiber in an outer case also in the above "a canning method" since the compression width of face of ceramic fiber is large. Consequently, the planar pressure of ceramic fiber runs short, and during engine operation, the catalyst support made from a ceramic rocks, and damages and is afraid.

[0011] Moreover, also in the above "a canning method", a cross-section C character type outer case is prepared, and there is a possibility that ceramic fiber may concentrate and may be compressed to the C character type comparison section in the above-mentioned outer case, by the "volume bundle method" which rolls and fastens the above-mentioned outer case after inserting the maintenance material which consists of catalyst support made from a ceramic, and ceramic fiber in this outer case.

[0012] In this case, there is a possibility that it may compare at the time of overbolting, and the ceramic fiber of the section may be damaged. On the other hand, when it compares and bolting of the ceramic fiber of the section is made proper, in the part which it compares and the section counters, there is a possibility that the planar pressure of ceramic fiber may run short. That is, a possibility that an ununiformity may arise is in the maintenance planar pressure of the catalyst support made from a ceramic. Consequently, the planar pressure of ceramic fiber runs short, and during engine operation, the catalyst support made from a ceramic rocks, and damages and is afraid.

[0013] Moreover, the maintenance material which prepares one of the above "a canning method" and the half-segmented piece of the configuration where two division etc. carried out the above-mentioned outer case, and becomes one side of this half-segmented piece from the catalyst support made from a ceramic and ceramic fiber is set in another half-segmented piece arrangement and after that to the "clamshell method" which carries out compression immobilization of these. Since the above-mentioned ceramic fiber concentrates and is compressed like ** and the above "a volume bundle method" in the part which two half-segmented pieces poke mutually, a possibility that an ununiformity may arise is in the maintenance planar pressure of the catalyst support made from a ceramic. Consequently, the planar pressure of ceramic fiber runs short, and during engine operation, the catalyst support made from a ceramic rocks, and damages and is afraid.

[0014] On the other hand, after inserting the catalyst support made from a ceramic wrapped in a wire network in the larger outer case in JP,57-116118,A, the edge and center section of the outer case are pressed and the manufacture approach which sticks the catalyst support made from a ceramic and an outer case by pressure is shown. In this manufacture approach, the gap section is prepared between the catalyst support made from a ceramic and the outer cases which were wrapped in the

wire network. Therefore, the catalyst support made from a ceramic moved within the outer case at the time of press of the above-mentioned outer case, and there was a possibility that positioning immobilization of the catalyst support made from a ceramic might not work.

[0015] Furthermore, at the time of the above-mentioned press, the outer case needed to be strongly pressed so that the above-mentioned gap section might be lost, large-sized equipment and two or more equipments were needed for this press, and there was a possibility that manufacture of a ceramic catalytic converter might become difficult.

[0016] Moreover, in JP,6-238173,A, after inserting the catalyst support made from metal into a larger outer case, the manufacture approach which reduces the diameter of an outer case by the diaphragm tool, and carries out [tacking] of the catalyst support made from metal and the outer case is shown. However, also in this manufacture approach, since the gap section is prepared between an outer case and the catalyst support made from metal, there is a possibility that the same problem as the conventional technique of above-mentioned JP,57-116118,A may arise.

[0017] In view of this trouble, as for this invention, the catalyst support made from a ceramic always tends to offer stability, the manufacture approach of the ceramic catalytic converter currently certainly held in the outer case, and a ceramic catalytic converter.

[0018]

[Means for Solving the Problem] Invention of claim 1 is inserted in the above-mentioned outer case which in making maintenance material intervene in a metal outer case, and attaching the catalyst support made from a ceramic equips the periphery section of the above-mentioned catalyst support made from a ceramic with the above-mentioned maintenance material, and has a bore a little smaller subsequently than the maintenance material outer diameter after equipping with this. It is in the manufacture approach of the ceramic catalytic converter characterized by carrying out the taper status change form of the above-mentioned outer case, and carrying out perimeter diameter reduction until the above-mentioned maintenance material comes to have predetermined planar pressure for an assembly, and nothing, after that and this assembly.

[0019] The above-mentioned taper status change form is extruded making the shape of a taper carry out diameter reduction deformation one by one from the end face of an outer case, and means the deformation approach of making the diameter of the whole outer case reducing finally. Moreover, in the case of this deformation, in the direction of a path, the perimeter of the above-mentioned outer case is pressed as it is also at the force of uniform magnitude.

[0020] Moreover, it is desirable to use what does not contain thermal-expansion matter, such as a vermiculite and a mica, and does not carry out a phase transformation as the above-mentioned maintenance material in the periphery section temperature of the periphery section of the catalyst support made from a ceramic at the time of exhaust air purification.

[0021] Degradation of the above-mentioned maintenance material and the fall of the planar pressure of maintenance material can be prevented under an environment by which the above-mentioned ceramic catalytic converter is put by this to the hot exhaust gas exceeding 850 degrees C. Furthermore, by using the ingredient which does not carry out a phase transformation as the above-mentioned maintenance material, it is stabilized and the catalyst support made from a ceramic can be held for a long period of time.

[0022] Furthermore, as the above-mentioned maintenance material, they are aluminum 2O3 and SiO2, for example. It is the alumina fiber of a presentation and is aluminum 2O3 in this alumina fiber. That whose content is 70 % of the weight or more can be used.

[0023] In the manufacture approach of this invention, in the assembly which inserted the catalyst support made from a ceramic equipped with maintenance material in the outer case, the taper status change form of the outer case is carried out, and perimeter diameter reduction is carried out until maintenance material comes to have predetermined planar pressure. For this reason, in the above-mentioned maintenance material, neither the part it becomes superfluous compressing, nor the part it becomes insufficient compressing can be generated, but uniform planar pressure can be generated in the perimeter of an outer case in it.

[0024] Moreover, through the taper status change form of an outer case, perimeter diameter reduction of the above-mentioned maintenance material is carried out until the above-mentioned maintenance material has predetermined planar pressure. For this reason, breakage does not occur for the fiber which constitutes maintenance material, therefore the catalyst support made from a ceramic can be attached in an outer case stably and certainly.

[0025] As mentioned above, according to this invention, the catalyst support made from a ceramic can offer stability and the manufacture approach of a ceramic catalytic converter currently certainly held in the outer case.

[0026] Next, as for the insertion cost when inserting the above-mentioned assembly in the above-mentioned outer case, it is desirable to be referred to as 10mm or less. Positioning insertion of the catalyst support made from a ceramic and the maintenance material can be carried out into an outer case, without damaging by this the fiber which constitutes maintenance material. In addition, the above-mentioned

insertion cost is the difference of the maintenance material outer diameter after equipping the periphery section of the catalyst support made from a ceramic with maintenance material, and an outer case bore. Furthermore, as for the thickness before diameter reduction of the above-mentioned outer case, it is desirable to be referred to as 2.0mm or less. Thereby, the diameter of an outer case can be reduced easily.

[0027] Moreover, the outside of the above-mentioned outer case can be equipped with the different outermost cylinder from this outer case. The thinning of the outer case with which diameter reduction is given becomes possible, and it can be compatible in assembliability and endurance with this configuration. Moreover, as for the outermost cylinder with which the outside of the above-mentioned outer case is equipped, it is desirable from the point of both weldability to consist of the same quality of the material as the above-mentioned outer case. moreover, the coefficient of thermal expansion of the outermost cylinder -- the coefficient of thermal expansion of the above-mentioned outer case -- the same -- or it is desirable from the point of endurance that it is less than [it] (drawing 7).

[0028] Next, it is desirable like invention of claim 2 that the taper angle at the time of the taper status change form of the above-mentioned outer case is the include angle of 3-30 degrees to the direction of an outer case medial axis (refer to drawing 4 and drawing 5). Thereby, the fiber which constitutes the above-mentioned maintenance material at the time of perimeter diameter reduction of an outer case does not receive the bending force 30 degrees or more. Therefore, bending fracture of the fiber at the time of diameter reduction can be prevented. Furthermore, the diameter can be easily reduced by the ability making small reaction force at the time of a taper status change form.

[0029] the extrusion die length for reducing the diameter of a request, when the above-mentioned include angle is less than 3 degrees -- long -- becoming -- spinning -- public funds -- there is a possibility that the problem of enlargement of equipments including a mold and an extruder may arise. When the above-mentioned include angle is larger than 30 degrees, the fiber which constitutes maintenance material at the time of diameter reduction is fractured, and there is a possibility that it may become impossible for maintenance material to demonstrate planar pressure.

[0030] Next, as for the maintenance material of a front with [above-mentioned] a group, it is desirable like invention of claim 3 to have the shape of a cylindrical shape of the shape of the shape of a space form between the above-mentioned catalyst support made from a ceramic and the above-mentioned outer case before diameter reduction and abbreviation isomorphism.

[0031] Thereby, the catalyst support made from a ceramic and maintenance material

can be easily attached in an outer case. Moreover, this process is automatable. In addition, as for the above-mentioned maintenance material, it is desirable from the point of endurance and attachment nature that compression molding is carried out using the binder containing an organic substance. Moreover, protection of the maintenance material at the time of inserting the catalyst support made from a ceramic which equipped the above-mentioned outer case with maintenance material with the above-mentioned binder can be aimed at.

[0032] Next, it is desirable like invention of claim 4 to perform diameter reduction of the above-mentioned outer case by spinning. Thereby, the equipment used for processing can be simplified.

[0033] Next, it is desirable like invention of claim 5 to extrude with other assemblies with which the above-mentioned spinning follows a front assembly in the extrusion process (drawing 4). Spinning can be performed efficiently continuously, without changing by this the ejector-plate (after-mentioned) diameter of the extruder used in an extrusion process.

[0034] Next, the catalyst support made from a ceramic which invention of claim 6 has been arranged in an engine exhaust air path, and formed the catalyst bed in the cel front face, In the ceramic catalytic converter which consists of the outer case which contains the above-mentioned catalyst support made from a ceramic, the above-mentioned outer case, and maintenance material arranged in the opening between the above-mentioned catalyst support made from a ceramic The above-mentioned maintenance material does not contain the thermal-expansion matter, and it does not carry out a phase transformation in the periphery section temperature of the periphery section of the catalyst support made from a ceramic at the time of exhaust air purification. And the above-mentioned outer case After inserting what equipped the above-mentioned catalyst support periphery section made from a ceramic with the above-mentioned maintenance material, it is in the ceramic catalytic converter characterized by carrying out perimeter diameter reduction through a taper status change form until the above-mentioned maintenance material has predetermined planar pressure.

[0035] Thereby, since the above-mentioned maintenance material does not deteriorate in an elevated temperature, the above-mentioned catalyst support made from a ceramic can be certainly held in an outer case. Moreover, according to the above-mentioned taper status change form, in the above-mentioned maintenance material, neither the part it becomes superfluous compressing, nor the part it becomes insufficient compressing can be generated, but uniform planar pressure can be generated in the perimeter of an outer case in it. Moreover, since breakage does not occur for the fiber which constitutes maintenance material, the catalyst support

made from a ceramic can be attached in an outer case stably and certainly.
[0036] As mentioned above, according to this invention, the catalyst support made from a ceramic can offer stability and the ceramic catalytic converter currently certainly held in the outer case.
[0037]
[Embodiment of the Invention]
It explains using drawing 1 – drawing 6 about the manufacture approach of a ceramic catalytic converter and ceramic catalytic converter concerning the example of an operation gestalt of example of operation gestalt 1 this invention. In making the maintenance material 11 intervene in the metal outer case 13, and attaching the catalyst support 12 made from a ceramic of this example, as shown in drawing 2 – drawing 5 , first, the periphery section 120 of the above-mentioned catalyst support 12 made from a ceramic is equipped with the above-mentioned maintenance material 11, and it inserts in the above-mentioned outer case 13 which has a bore a little smaller subsequently than the outer diameter of the maintenance material 11 after equipping with this, and makes with an assembly 10. Then, the taper status change form of the above-mentioned outer case 13 is carried out, and perimeter diameter reduction is carried out until the above-mentioned maintenance material 11 comes to have predetermined planar pressure for this assembly 10.
[0038] Next, it explains to the following per [concerning this example] ceramic catalytic converter 1. As shown in drawing 1 and drawing 6 , the ceramic catalytic converter 1 of this example is arranged in the exhaust air path of an engine 25, and consists of the catalyst support 12 made from a ceramic in which the catalyst bed was formed on the cel front face, the outer case 13 which contains the above-mentioned catalyst support 12 made from a ceramic, the above-mentioned outer case 13, and maintenance material 11 arranged in the opening between the above-mentioned catalyst support 12 made from a ceramic.
[0039] And the above-mentioned maintenance material 11 does not contain the thermal-expansion matter, and it does not carry out a phase transformation in the periphery section temperature of the periphery section 120 of the catalyst support 12 made from a ceramic at the time of exhaust air purification. Moreover, through the taper status change form, after inserting what equipped the periphery section 120 of the above-mentioned catalyst support 12 made from a ceramic with the above-mentioned maintenance material 11, perimeter diameter reduction of the above-mentioned outer case 13 is carried out until the above-mentioned maintenance material 11 has predetermined planar pressure. In addition, in drawing 1 , a sign 151,152 is a flange.
[0040] In addition, the above-mentioned catalyst support 12 made from a ceramic has

the shape of a cylindrical shape with a diameter [of 71mm], and a die length of 60mm. Many honeycomb-like aeration cels are formed in the interior, and the wall thickness is 0.08-0.13mm. The above-mentioned catalyst support 12 made from a ceramic is constituted by the light-gage ceramic which consists of a cordierite system ceramic (2MgO-2aluminum2 O3 and 5SiO2) of a low-fever expansion coefficient.

[0041] Moreover, the catalyst for making the injurious ingredient in exhaust gas purify is supported by the aeration cel of the above-mentioned catalyst support 12 made from a ceramic. In addition, support of the above-mentioned catalyst is performed as shown below. It is gamma-aluminum 2O3 about the above-mentioned catalyst support 12 made from a ceramic. It is made to sink in into the contained slurry and calcinates. And it is made to sink in into the water solution which dissolved Pt which is a catalyst metal, Rh, etc., and calcinates again.

[0042] Next, the above-mentioned maintenance material 11 is aluminum 2O3. 72 % of the weight and SiO2 It consists of an alumina fiber of the presentation of 28 % of the weight. And the thermal-expansion matter used as the cause of reducing thermal resistance is not contained. Moreover, the heat-resistant temperature of the above-mentioned maintenance material 11 is 1800 degrees C, and does not carry out a phase transformation in the periphery section temperature (900 degrees C of abbreviation) of the periphery section 120 of the catalyst support 12 made from a ceramic at the time of exhaust air purification. In addition, the diameter of fiber of each one fiber which constitutes the above-mentioned maintenance material 11 is 2-4 micrometers.

[0043] moreover, compression molding of the above-mentioned maintenance material 11 is carried out with a binder to a front with a group -- having -- **** -- the thickness -- 10mm and bulk density -- 0.12 g/cm3 it is -- in a front with [to the catalyst support 12 made from a ceramic] a group, an outer diameter is 91mm. The above-mentioned outer case 13 consists of a pipe of a ferrite system heatproof stainless steel material. And it has the shape of a cylindrical shape the bore of 88mm, width of face of 73mm, and whose board thickness are 1.5mm before diameter reduction, and after diameter reduction serves as the shape of a cylindrical shape the bore of 80mm, width of face of 75mm, and whose board thickness are 1.6mm.

[0044] Moreover, the above-mentioned flange 151 consists of ferrite system heatproof stainless steel, and are the bore of 67mm, the outer diameter of 94mm, and 8mm of board thickness. On the other hand, a flange 152 consists of ferrite system heatproof stainless steel, and the bore of 67mm, the outer diameter of 94mm, and board thickness are 6mm. In addition, all the above-mentioned ferrite system heatproof stainless steel is SUSs430.

[0045] Next, the assembly of the above-mentioned ceramic catalytic converter 1 is

explained to a detail. First, binders (for example, phenol resin or an epoxy resin etc.) are sunk into the maintenance material 11, and this is fabricated in the shape of a cylindrical shape. Next, as shown in drawing 2 (a), the above-mentioned catalyst support 12 made from a ceramic is inserted to the cylindrical shape maintenance material 11 of the above. After insertion, the both-ends side of the above-mentioned maintenance material 11 will be in the condition of having projected 5mm of abbreviation from the both-ends side of the catalyst support 12 made from a ceramic (refer to drawing 2 (b)).

[0046] Next, as shown in drawing 2 (b), the above-mentioned outer case 13 is inserted to the catalyst support 12 made from a ceramic covered with the above-mentioned maintenance material 11. It carries out using the fixture which is not illustrated, and the catalyst support 12 made from a ceramic which covered the above-mentioned maintenance material 11 in the above-mentioned outer case 13 does not shake, but let this insertion be both positioning extent. By the above, the assembly 10 shown in drawing 3 (a) is obtained.

[0047] Next, as shown in drawing 4 (a), the above-mentioned assembly 10 is set to two and the spinning machine 4. It explains here per above-mentioned spinning machine 4. the above-mentioned spinning machine 4 -- spinning -- public funds -- a mold 41 and an extruder 42 -- becoming -- the above-mentioned spinning -- public funds -- a mold 41 has the cavity 410 which formed the taper section 411, as shown in drawing 4 (a) and drawing 5 . The taper angle alpha of the above-mentioned taper section 411 is about 5 degrees. In addition, in drawing 4 , a sign 421 is a press plate and a sign 422 is an air chamber.

[0048] and it is shown in drawing 4 (a) -- as -- the above-mentioned spinning -- public funds -- the piston 420 of an extruder 42 is moved in the cavity 410 in a mold 41, and the above-mentioned assembly 10 is extruded. As shown in drawing 4 (b) and drawing 5 , in case the above-mentioned assembly 10 passes the taper section 411 of the above-mentioned cavity 410, the diameter of the outer diameter is reduced, and the path of the catalyst support 12 made from a ceramic remains as it is, and the thickness of the above-mentioned outer case 13 and the thickness of the above-mentioned maintenance material 11 are reduced.

[0049] then, the consecutive assembly 10 and the assembly 18 with which diameter reduction of an outer case 13 was able to be managed with the piston 420 -- the above-mentioned spinning -- public funds -- it extrudes from a mold 41. By the above, whenever the assembly 10 shown in drawing 3 (a) shows drawing 3 (b), it comes, and it becomes the assembly 18 whose diameter was reduced. Subsequently, in the cavity 410 behind the above-mentioned assembly 10, as shown in drawing 4 (b), the following assembly 10 is inserted and the above-mentioned spinning is performed continuously

similarly.

[0050] Then, to the both ends of the assembly 18 with which the above-mentioned diameter reduction ended, as shown in drawing 1 , a flange 151,152 is inserted in and welded. In addition, in order that the above-mentioned flange 151,152 may prevent the exhaust gas leak between a flange 151,152 and an outer case 13, perimeter junction of between both is carried out. By the above, the ceramic catalytic converter 1 concerning this example is obtained.

[0051] Next, as shown in drawing 6 , the ceramic catalytic converter 1 of this example is installed into the exhaust air path of car motor 25. Connection immobilization of the above-mentioned ceramic catalytic converter 1 is carried out with a bolt through the gasket which is not illustrated between the mounting flange 241 of EKIZOSUTOMANIHORUDO 261,262, and the mounting flange 242 of the start catalyst 21. The above-mentioned engine 25 is 4000 cc in displacement, every four of eight manifolds 26 drawn from this engine 25 gather, and they turn into two EKIZOSUTOMANIHORUDO 261,262.

[0052] And in above-mentioned EKIZOSUTOMANIHORUDO 261,262, the start catalyst 21 to which the ceramic catalytic converter 1 has the capacity of 1300 cc on the lower stream of a river further is arranged, respectively. In addition, the above-mentioned ceramic catalytic converter 1 is arranged directly under EKIZOSUTOMANIHORUDO 261,262.

[0053] Maintenance immobilization of the above-mentioned start catalyst 21 has been carried out through the wire network or the ceramic fiber mat into the outer case 211 for start catalysts. Connection immobilization of the downstream flange 243 of the above-mentioned outer case 211 has been carried out to the flange 244 prepared in the exhaust pipe 221,222.

[0054] Moreover, rather than the above-mentioned start catalyst 21, further, the above-mentioned exhaust pipe 221,222 joins in the downstream, and is connected to the 1000 cc catalyst which is not illustrated. The temperature up of the ceramic catalytic converter 1 of this example is carried out to 400 degrees C - 500 degrees C from starting by putting an engine 25 into operation with the above-mentioned configuration by the heat from the exhaust gas discharged from an engine 25 after about 10 - 15 seconds (an engine is an idling condition). The catalyst bed supported by the catalyst support 12 made from a ceramic is activated by this, and purification of exhaust gas is performed.

[0055] Next, it explains per [in this example] operation effectiveness. In the manufacture approach of the ceramic catalytic converter 1 concerning this example, the assembly 10 which inserted the catalyst support 12 made from a ceramic equipped with the maintenance material 11 in the outer case 13 carries out the taper

status change form of the outer case 13, and carries out perimeter diameter reduction until the above-mentioned maintenance material 11 comes to have predetermined planar pressure. For this reason, in the above-mentioned maintenance material 11, neither the part it becomes superfluous compressing, nor the part it becomes insufficient compressing can be generated, but uniform planar pressure can be generated in the perimeter of an outer case 13 in it.

[0056] Moreover, through the taper status change form of an outer case 13, perimeter diameter reduction of the above-mentioned maintenance material 11 is carried out until the above-mentioned maintenance material 11 has predetermined planar pressure. For this reason, breakage does not occur for the fiber which constitutes the maintenance material 11, therefore the catalyst support 12 made from a ceramic can be attached in an outer case 13 stably and certainly.

[0057] Furthermore, as shown in drawing 4 and drawing 5 , the diameter of it can be reduced, without 5 degrees and the fiber which constitutes the maintenance material 11 since it is small carrying out bending fracture until the taper angle alpha in the case of the above-mentioned diameter reduction generates predetermined maintenance planar pressure. moreover, the taper angle alpha -- 5 degrees and since it is small -- the spinning of an outer case 13 -- public funds -- in the time of the extrusion from a mold 41, reaction force in the above-mentioned taper section 411 can be made small, and this process can be made easy.

[0058] In addition, since the thickness of the above-mentioned outer case 13 is 1.5mm, a diameter reduction process is easy for it, and a crack does not produce it in this outer case 13 at the time of diameter reduction. By the above, according to this example, there is no damage on the fiber which constitutes the maintenance material 11 in the case of the manufacture, and the catalyst support 12 made from a ceramic can offer stability and the ceramic catalytic converter 1 currently held certainly.

[0059] Moreover, whenever the above-mentioned maintenance material 11 mentioned above, it comes, and it is constituted by the alumina fiber. The above-mentioned alumina fiber is stable matter which does not carry out a phase transformation, if temperature does not exceed 1800 degrees C. And no thermal-expansion matter in which thermal resistance is inferior to the above-mentioned alumina fiber, such as a vermiculite and a mica, is contained in the above-mentioned maintenance material 11.

[0060] When the volume decreases or planar pressure falls, it does not necessarily become impossible for this reason, for the above-mentioned alumina fiber to hold the catalyst support 12 made from a ceramic in extent heated by the exhaust gas discharged from an engine 25. Therefore, also in an elevated-temperature ambient atmosphere, maintenance of the catalyst support 12 made from a ceramic can be stabilized over a long period of time.

[0061] Moreover, in the manufacture approach of this example, the maintenance material 11 fabricated with the binder is formed in the catalyst support 12 made from a ceramic, and these are inserted into an outer case 13 after that. For this reason, positioning between these 3 persons is easy. Moreover, since compression molding of the above-mentioned maintenance material 11 is carried out with the binder to the front with a group, it is easy to deal with it, and only the part of compression molding can make smaller the amount of diameter reduction of an outer case 13. Moreover, in case the catalyst support 12 made from a ceramic which equipped the above-mentioned outer case 13 with the maintenance material 11 is inserted with a binder, the maintenance material 11 can be protected. Furthermore, since the above-mentioned maintenance material 11 has the shape of a cylindrical shape of the shape of the shape of a space form of the above-mentioned catalyst support 12 made from a ceramic, and the above-mentioned outer case 13, and abbreviation isomorphism, it is easy to attach.

[0062] Moreover, the insertion cost in the case of inserting the catalyst support 12 made from a ceramic which equipped the above-mentioned outer case 13 with the maintenance material 11 is 3mm in diameter, and the bulk density of the maintenance material 11 before insertion is also 0.12 g/cm3. It is small. For this reason, the fiber of the maintenance material 11 is not damaged in the case of the above-mentioned insertion.

[0063] Moreover, the above-mentioned ceramic catalytic converter 1 is arranged directly under EKIZOSUTOMANIHORUDO 261,262, and can receive many energy which exhaust gas has as compared with the catalytic converter arranged especially in the conventional under floor. And since the above-mentioned catalyst support 12 made from a ceramic consists of monoliths of a thin wall, its heat capacity is comparatively small. For the above reason, the temperature up of the ceramic catalytic converter 1 of this example can be carried out after engine starting in a short time, and it can make a catalyst an activated state. That is, it has a high rate of exhaust air purification immediately after engine starting.

[0064] moreover, the spinning in which diameter reduction of the above-mentioned outer case 13 has the taper section 411 in case the ceramic catalytic converter 1 of this example is manufactured -- public funds -- it carries out using the spinning machine 4 which used the mold 41. This spinning machine 4 is easy structure, and can make a manufacturing cost cheap. Moreover, it extrudes with other assemblies with which the spinning using the above-mentioned spinning machine 4 follows a front assembly in the extrusion process. Thereby, spinning can be performed continuously and efficiently.

[0065] The example 2 of an operation gestalt and this example are the ceramic

catalytic converters 1 manufactured by the same manufacture approach as the example 1 of an operation gestalt, and are the ceramic catalytic converter which has arranged the outermost cylinder 19 of another member further on the outside of the outer case 13, and was made into double pipe structure.

[0066] In manufacture of the above-mentioned ceramic catalytic converter 1, to the outer diameter of the assembly 18 (drawing 3 (b)) whose diameter was reduced by the same spinning as the example 1 of an operation gestalt, the outermost cylinder 19 with the bore large [0.5mm of abbreviation] is attached, for example, perimeter junction is carried out by two-place laser welding. In addition, in this drawing, 190 is welding marks. Others are the same as that of the example 1 of an operation gestalt.

[0067] Since the catalyst support 1 made from a ceramic concerning this example comes to prepare the outermost cylinder 19, it can make light-gage (1.0mm of for example, board thickness) the outer case 13 whose diameter is reduced. It becomes easy to reduce [of an outer case 13] the diameter this, and the reinforcement as a ceramic catalytic converter 1 can maintain the outermost cylinder 19. Therefore, according to this example, diameter reduction can obtain the easy ceramic catalytic converter 1 with both high endurance.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The cross-section explanatory view of the ceramic catalytic converter in the example 1 of an operation gestalt.

[Drawing 2] The attachment explanatory view of the ceramic catalytic converter in the example 1 of an operation gestalt.

[Drawing 3] The attachment explanatory view of the ceramic catalytic converter following drawing 2 in the example 1 of an operation gestalt.

[Drawing 4] The explanatory view of spinning to an assembly in the example 1 of an operation gestalt.

[Drawing 5] The partial cross-section explanatory view of the assembly in the middle of diameter reduction in the example 1 of an operation gestalt.

[Drawing 6] The arrangement explanatory view of the ceramic catalytic converter in the exhaust air path of car motor in the example 1 of an operation gestalt.

[Drawing 7] The explanatory view of the ceramic catalytic converter which prepared the outermost cylinder in the example 2 of an operation gestalt.

[Description of Notations]

1 ... a ceramic catalytic converter,

10 18 ... Assembly,

11 ... maintenance material,

12 ... the catalyst support made from a ceramic,

13 ... an outer case,

19 ... the outermost cylinder,

[Translation done.]

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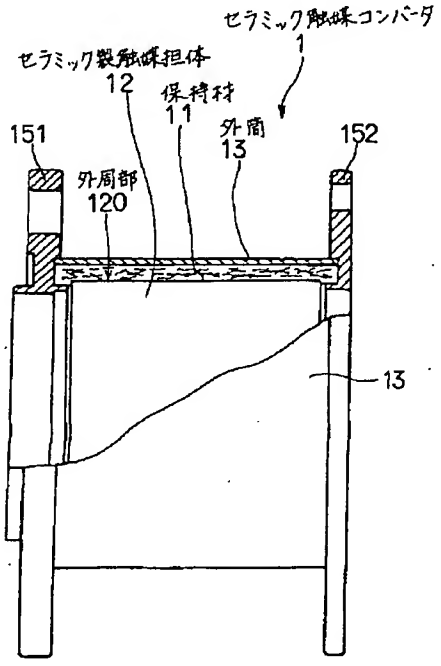
(54)【発明の名称】　セラミック触媒コンバータの製造方法及びセラミック触媒コンバータ

(57)【要約】

【課題】　常にセラミック製触媒担体が安定かつ確実に外筒内に保持されている，セラミック触媒コンバータの製造方法及びセラミック触媒コンバータを提供すること。

【解決手段】　金属製の外筒１３内に，保持材１１を介在させてセラミック製触媒担体１２を組付けるに当たって，上記セラミック製触媒担体１２の外周部１２０に上記保持材１１を装着し，次いでこれを装着後の保持材１１外径よりやや小さな内径を有する上記外筒１３に挿入して組付体１０となし，その後，該組付体１０を上記保持材１１が所定の面圧を有するようになるまで，上記外筒１１をテーパ状変形させて全周縮径する。



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【特許請求の範囲】

【請求項１】　金属製の外筒内に，保持材を介在させてセラミック製触媒担体を組付けるに当たって，上記セラミック製触媒担体の外周部に上記保持材を装着し，次いでこれを装着後の保持材外径よりやや小さな内径を有する上記外筒に挿入して組付体となし，その後，該組付体を上記保持材が所定の面圧を有するようになるまで，上記外筒をテーパ状変形させて全周縮径することを特徴とするセラミック触媒コンバータの製造方法。

【請求項２】　請求項１において，上記外筒のテーパ状変形時のテーパ角が外筒中心軸方向に対し，３～３０°の角度であることを特徴とするセラミック触媒コンバータの製造方法。

【請求項３】　請求項１又は２において，上記組付前の保持材は，上記セラミック製触媒担体と縮径前の上記外筒との間の空間形状と略同形状の円筒形状を有していることを特徴とするセラミック触媒コンバータの製造方法。

【請求項４】　請求項１～３のいずれか一項において，上記外筒の縮径は絞り加工により行うことを特徴とするセラミック触媒コンバータの製造方法。

【請求項５】　請求項４において，上記絞り加工は，その押出工程において，前方の組付体は後続する他の組付体により押し出されることを特徴とするセラミック触媒コンバータの製造方法。

【請求項６】　エンジンの排気経路中に配置され，セル表面に触媒層を形成したセラミック製触媒担体と，上記セラミック製触媒担体を収納する外筒と，上記外筒と上記セラミック製触媒担体間の空隙に配設された保持材とからなるセラミック触媒コンバータにおいて，上記保持材は熱膨張物質を含まず，かつ排気浄化時におけるセラミック製触媒担体の外周部の外周部温度において相変態せず，かつ，上記外筒は，上記セラミック製触媒担体外周部に上記保持材を装着したものを挿入した後，テーパ状変形を経て，上記保持材が所定の面圧を有するまで全周縮径されていることを特徴とするセラミック触媒コンバータ。

【発明の詳細な説明】

【０００１】

【技術分野】本発明は，自動車等の車両用エンジンの排気経路中に配置されるセラミック触媒コンバータに関する。

【０００２】

【従来技術】自動車用エンジンの排気経路中には，排気ガス浄化用のセラミック触媒コンバータが設けてある。従来，上記セラミック触媒コンバータは，セル表面に触媒層を形成したセラミック製触媒担体と，上記セラミック製触媒担体を収納する外筒とからなるものが知られている。

【０００３】そして，上記セラミック製触媒担体として

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は低熱膨張係数のコージェライト系セラミック（$2MgO \cdot 2Al_2O_3 \cdot 5SiO_2$）が使用されており，これには十数年の使用実績がある。また，上記セラミック製触媒担体の通気セル表面には，自動車エンジンの排気ガス中に含まれるＣＯ，ＨＣ及びＮＯｘ等の有害成分を無害な気体あるいは水に変換するためのＰｔ，Ｒｈ，Ｐｄ等の貴金属よりなる触媒層が担持してある。

【０００４】ところで，上記セラミック製ハニカム担体は，一般にじん性が低く脆い。このため，実公平４－２６６４９号公報には，セラミック短繊維にバーミキュライト，マイカ等の熱膨張物質を混入した熱膨張性セラミックマットよりなる保持材で上記セラミック製ハニカム担体をくるみ，上記外筒に収納することが提案されており，一部で実用化されている。

【０００５】しかしながら，上述の各種熱膨張物質は，８５０℃を越える高温の排気ガスに曝されることにより劣化が激しく進行するため，高温におけるセラミック製触媒担体の外筒内での保持に関しては，十分な信頼性を保証できるまでには至っていない。

【０００６】即ち，高温における上記熱膨張物質の劣化と共に，上記セラミックマットの触媒担体の保持能力が低下し，自動車走行時の振動等により外筒内において触媒担体ががたつき，破損することがあった。

【０００７】そこで，特開平７－７７０３６号に示されるごとく，上記保持材として耐熱・非膨張性のセラミック繊維を用いることが提案されている。上記セラミック繊維を使用することで，８５０℃を超える高温の排気ガス雰囲気下においても，セラミック製触媒担体を外筒内において確実に保持することが可能となる。

【０００８】

【解決しようとする課題】しかしながら，上述した非膨張性のセラミック繊維を保持材として用いた場合，以下に示す問題が発生するおそれがある。即ち，上記保持材は非膨張性であるため，常温での体積と高温での体積との間に変化が殆どない。しかし，高温の排気ガスに曝されることにより，上記外筒は熱膨張により径そのものが拡大する。

【０００９】このため，常温から高温にかけて，上記セラミック製触媒担体を確実に保持するためには，外筒への組付け時における保持材の圧縮幅を非常に大きく取る必要がある。その結果，特開平７－７７０３６号に示される『キャニング方式』では，以下に詳説するごとく，セラミック触媒コンバータがエンジン稼働中に破損するおそれがあった。

【００１０】即ち，上記『キャニング方式』の中でも，外筒内にセラミック製触媒担体及びセラミック繊維よりなる保持材を共に押込む『押込み方式』では，セラミック繊維の圧縮幅が大きいために，押込み中に外筒の角部でセラミック繊維が急激な変形を受け，これが破損するおそれがある。その結果，セラミック繊維の面圧が不足

し，エンジン稼働中にセラミック製触媒担体が揺動し破損するおそれある。

【００１１】また，上記『キャニング方式』の中でも，断面Ｃ字型の外筒を準備し，該外筒内にセラミック製触媒担体とセラミック繊維よりなる保持材を挿入後，上記外筒を巻き締める『巻き締め方式』では，上記外筒におけるＣ字型の突き合わせ部に対し，セラミック繊維が集中して圧縮されるおそれがある。

【００１２】この場合，締め付け過剰時には突き合せ部のセラミック繊維が破損するおそれがある。一方，突き合せ部のセラミック繊維の締め付けを適正にした場合には，突き合せ部の対向する部分において，セラミック繊維の面圧が不足するおそれがある。即ち，セラミック製触媒担体の保持面圧に不均一が生じるおそれがある。その結果，セラミック繊維の面圧が不足し，エンジン稼働中にセラミック製触媒担体が揺動し破損するおそれある。

【００１３】また，上記『キャニング方式』のひとつ，上記外筒を２分割等した形状の半割片を準備し，この半割片の一方にセラミック製触媒担体とセラミック繊維よりなる保持材を配置，その後，もう一方の半割片にてこれらを圧縮固定する『クラムシェル方式』においても，上記『巻き締め方式』と同様に，二つの半割片が突き合う部分において上記セラミック繊維が集中して圧縮されるために，セラミック製触媒担体の保持面圧に不均一が生じるおそれがある。その結果，セラミック繊維の面圧が不足し，エンジン稼働中にセラミック製触媒担体が揺動し破損するおそれある。

【００１４】一方，特開昭５７－１１６１１８号公報において，大きめの外筒内にワイヤネットで包まれたセラミック製触媒担体を挿入した後，外筒の端部と中央部とを押圧し，セラミック製触媒担体と外筒とを圧着する製造方法が示されている。この製造方法においては，ワイヤネットに包まれたセラミック製触媒担体と外筒との間には間隙部が設けてある。そのため，上記外筒の押圧時にセラミック製触媒担体が外筒内で動き，セラミック製触媒担体の位置決め固定がうまくいかないおそれがあった。

【００１５】さらに，上記押圧時には，上記間隙部がなくなるように外筒を強く押圧する必要があり，この押圧には大型の装置，複数の装置が必要となり，セラミック触媒コンバータの製造が困難となるおそれがあった。

【００１６】また，特開平６－２３８１７３号公報において，大きめの外筒内にメタル製触媒担体を挿入した後，絞り工具にて外筒を縮径してメタル製触媒担体と外筒とを仮止めする製造方法が示されている。しかしながら，この製造方法においても，外筒とメタル製触媒担体との間に間隙部が設けてあることから，上記特開昭５７－１１６１１８号公報の従来技術と同様の問題が生じるおそれがある。

【００１７】本発明は，かかる問題点に鑑み，常にセラミック製触媒担体が安定かつ確実に外筒内に保持されている，セラミック触媒コンバータの製造方法及びセラミック触媒コンバータを提供しようとするものである。

【００１８】

【課題の解決手段】請求項１の発明は，金属製の外筒内に，保持材を介在させてセラミック製触媒担体を組付けるに当たって，上記セラミック製触媒担体の外周部に上記保持材を装着し，次いでこれを装着後の保持材外径よりやや小さな内径を有する上記外筒に挿入して組付体となし，その後，該組付体を上記保持材が所定の面圧を有するようになるまで，上記外筒をテーパ状変形させて全周縮径することを特徴とするセラミック触媒コンバータの製造方法にある。

【００１９】上記テーパ状変形とは，例えば，外筒の端面から順次テーパ状に縮径変形させながら押出し，最終的に外筒の全体を縮径させる変形方法をいう。また，この変形の際には，上記外筒の全周は径方向に均一な大きさの力でもって押圧される。

【００２０】また，上記保持材としては，バーミキュライト，マイカ等の熱膨張物質を含まず，かつ排気浄化時におけるセラミック製触媒担体の外周部の外周部温度において相変態しないものを使用することが好ましい。

【００２１】これにより，例えば８５０℃を越える高温の排気ガスに上記セラミック触媒コンバータが曝されるような環境下においても，上記保持材の劣化，保持材の面圧の低下を防止することができる。さらに，上記保持材として相変態しない材料を用いることにより，長期間，安定してセラミック製触媒担体を保持することができる。

【００２２】さらに，上記保持材としては，例えば，$Al_2O_3 \cdot SiO_2$ 組成のアルミナ繊維であって，該アルミナ繊維中のAl_2O_3の含有率が７０重量%以上であるものを用いることができる。

【００２３】本発明の製造方法においては，保持材を装着したセラミック製触媒担体を外筒に挿入した組付体において，保持材が所定の面圧を有するようになるまで，外筒をテーパ状変形させて全周縮径する。このため，上記保持材には，圧縮過剰となる部分も，圧縮不足となる部分も発生せず，外筒の全周において均一な面圧を発生することができる。

【００２４】また，上記保持材は，外筒のテーパ状変形を経て，上記保持材が所定の面圧を有するまで全周縮径される。このため，保持材を構成する繊維には破損が発生せず，従って，セラミック製触媒担体を安定かつ確実に外筒内に組付けることができる。

【００２５】以上のように，本発明によれば，常にセラミック製触媒担体が安定かつ確実に外筒内に保持されている，セラミック触媒コンバータの製造方法を提供することができる。

【００２６】次に，上記組付体を上記外筒に挿入する時の挿入代は１０ｍｍ以下とすることが好ましい。これにより，保持材を構成する繊維を破損させることなく，セラミック製触媒担体と保持材とを外筒内に位置決め挿入することができる。なお，上記挿入代とは，セラミック製触媒担体の外周部に保持材を装着した後の保持材外径と，外筒内径との差である。さらに，上記外筒の縮径前の肉厚は２．０ｍｍ以下とすることが好ましい。これにより，外筒の縮径を容易に行うことができる。

【００２７】また，上記外筒の外側には，この外筒とは異なる最外筒を装着することができる。この構成により，縮径の施される外筒の薄肉化が可能となり，組付性と耐久性とを両立することができる。また，上記外筒の外側に装着される最外筒は，上記外筒と同一の材質から成ることが両者の溶接性の点から好ましい。また，最外筒の熱膨張係数は上記外筒の熱膨張係数と同じ，またはそれ以下であることが，耐久性の点から好ましい（図７）。

【００２８】次に，請求項２の発明のように，上記外筒のテーパ状変形時のテーパ角が外筒中心軸方向に対し，３～３０°の角度であることが好ましい（図４，図５参照）。これにより，外筒の全周縮径時において，上記保持材を構成する繊維は３０°以上の曲げ力を受けることがない。よって，縮径時における，繊維の曲げ破断を防止することができる。更に，テーパ状変形時における反力を小さくすることができ，縮径を容易に行うことができる。

【００２９】上記角度が３°未満である場合には，所望の縮径を行うための押出長さが長くなり，絞り加工用金型及び押出機をはじめとする装置の大型化という問題が生じるおそれがある。上記角度が３０°よりも大きい場合には，縮径時に保持材を構成する繊維が破断され，保持材が面圧を発揮できなくなるおそれがある。

【００３０】次に，請求項３の発明のように，上記組付前の保持材は，上記セラミック製触媒担体と縮径前の上記外筒との間の空間形状と略同形状の円筒形状を有していることが好ましい。

【００３１】これにより，容易に外筒内にセラミック製触媒担体と保持材とを組付けることができる。また，この工程を自動化することができる。なお，上記保持材は，有機物質を含有するバインダを用いて圧縮成形されていることが，耐久性，組付け性の点から好ましい。また，上記バインダにより，上記外筒に保持材を装着したセラミック製触媒担体を挿入する際の保持材の保護を図ることができる。

【００３２】次に，請求項４の発明のように，上記外筒の縮径は絞り加工により行うことが好ましい。これにより，加工に使用する装置を簡略化することができる。

【００３３】次に，請求項５の発明のように，上記絞り加工は，その押出工程において，前方の組付体は後続する他の組付体により押し出されることが好ましい（図４）。これにより，押出工程において使用する押出し機の押出板（後述）直径を変化させることなく，連続的に効率よく絞り加工を行うことができる。

【００３４】次に，請求項６の発明は，エンジンの排気経路中に配置され，セル表面に触媒層を形成したセラミック製触媒担体と，上記セラミック製触媒担体を収納する外筒と，上記外筒と上記セラミック製触媒担体間の空隙に配設された保持材とからなるセラミック触媒コンバータにおいて，上記保持材は熱膨張物質を含まず，かつ排気浄化時におけるセラミック製触媒担体の外周部の外周部温度において相変態せず，かつ，上記外筒は，上記セラミック製触媒担体外周部に上記保持材を装着したものを挿入した後，テーパ状変形を経て，上記保持材が所定の面圧を有するまで全周縮径されていることを特徴とするセラミック触媒コンバータにある。

【００３５】これにより，高温においても上記保持材は劣化しないため，外筒内に上記セラミック製触媒担体を確実に保持することができる。また，上記テーパ状変形により，上記保持材には圧縮過剰となる部分も，圧縮不足となる部分も発生せず，外筒の全周において均一な面圧を発生することができる。また，保持材を構成する繊維に破損が発生しないため，セラミック製触媒担体を安定かつ確実に外筒内に組付けることができる。

【００３６】以上のように，本発明によれば，常にセラミック製触媒担体が安定かつ確実に外筒内に保持されている，セラミック触媒コンバータを提供することができる。

【００３７】

【発明の実施の形態】

実施形態例１

本発明の実施形態例にかかるセラミック触媒コンバータの製造方法及びセラミック触媒コンバータにつき，図１～図６を用いて説明する。図２～図５に示すごとく，金属製の外筒１３内に，保持材１１を介在させて本例のセラミック製触媒担体１２を組付けるに当たって，まず，上記セラミック製触媒担体１２の外周部１２０に上記保持材１１を装着し，次いでこれを装着後の保持材１１の外径よりやや小さな内径を有する上記外筒１３に挿入して組付体１０となす。その後，該組付体１０を上記保持材１１が所定の面圧を有するようになるまで，上記外筒１３をテーパ状変形させて全周縮径する。

【００３８】次に，本例にかかるセラミック触媒コンバータ１につき，以下に説明する。図１，図６に示すごとく，本例のセラミック触媒コンバータ１は，エンジン２５の排気経路中に配置され，セル表面に触媒層を形成したセラミック製触媒担体１２と，上記セラミック製触媒担体１２を収納する外筒１３と，上記外筒１３と上記セラミック製触媒担体１２間の空隙に配設された保持材１１とからなる。

【００３９】そして，上記保持材１１は熱膨張物質を含まず，かつ排気浄化時におけるセラミック製触媒担体１２の外周部１２０の外周部温度において相変態しない。また，上記外筒１３は，上記セラミック製触媒担体１２の外周部１２０に上記保持材１１を装着したものを挿入した後，テーパ状変形を経て，上記保持材１１が所定の面圧を有するまで全周縮径されている。なお，図１において，符号１５１，１５２はフランジである。

【００４０】なお，上記セラミック製触媒担体１２は，直径７１ｍｍ，長さ６０ｍｍの円柱形状である。その内部にはハニカム状の多数の通気セルが形成され，その壁厚は０．０８～０．１３ｍｍである。上記セラミック製触媒担体１２は，低熱膨張係数のコージェライト系セラミック（$2MgO-2Al_2O_3\cdot 5SiO_2$）よりなる薄肉セラミックにより構成されている。

【００４１】また，上記セラミック製触媒担体１２の通気セルには，排気ガス中の有害成分を浄化させるための触媒が担持されてある。なお，上記触媒の担持は以下に示すごとく行う。上記セラミック製触媒担体１２を$\gamma-Al_2O_3$を含有したスラリー中に含浸させ，焼成する。そして，触媒金属であるＰｔ，Ｒｈ等を溶解した水溶液中に含浸させ，再度焼成する。

【００４２】次に，上記保持材１１は，Al_2O_3が７２重量％，SiO_2が２８重量％という組成のアルミナ繊維からなる。そして，耐熱性を低下させる原因となる熱膨張物質は含まれていない。また，上記保持材１１の耐熱温度は１８００℃であり，排気浄化時におけるセラミック製触媒担体１２の外周部１２０の外周部温度（略９００℃）において相変態しない。なお，上記保持材１１を構成する各繊維１本の繊維径は２～４μｍである。

【００４３】また，上記保持材１１は，組付前にバインダーにより圧縮成形されており，その厚さは１０ｍｍ，かさ密度は０．１２ｇ／cm^3であり，セラミック製触媒担体１２への組付前では，外径は９１ｍｍである。上記外筒１３は，フェライト系耐熱ステンレス鋼素材のパイプよりなる。そして，縮径前は，内径８８ｍｍ，幅７３ｍｍ，板厚が１．５ｍｍの円筒形状であり，縮径後は，内径８０ｍｍ，幅７５ｍｍ，板厚が１．６ｍｍの円筒形状となる。

【００４４】また，上記フランジ１５１は，フェライト系耐熱ステンレス鋼よりなり，内径６７ｍｍ，外径９４ｍｍ，板厚８ｍｍである。一方，フランジ１５２は，フェライト系耐熱ステンレス鋼からなり，内径６７ｍｍ，外径９４ｍｍ，板厚が６ｍｍである。なお，上記フェライト系耐熱ステンレス鋼は，すべてＳＵＳ４３０である。

【００４５】次に，上記セラミック触媒コンバータ１の組立てについて，詳細に説明する。まず，保持材１１にバインダー（例えば，フェノール樹脂あるいはエポキシ樹脂等）を含浸し，これを円筒形状に成形する。次に，図２（ａ）に示すごとく，上記円筒形状の保持材１１に対し，上記セラミック製触媒担体１２を挿入する。挿入後には，上記保持材１１の両端面がセラミック製触媒担体１２の両端面から略５ｍｍ突出した状態となる（図２（ｂ）参照）。

【００４６】次に，図２（ｂ）に示すごとく，上記保持材１１により被覆したセラミック製触媒担体１２に対し，上記外筒１３を挿入する。この挿入は，図示しない治具を用いて行い，上記外筒１３内において，上記保持材１１を被覆したセラミック製触媒担体１２ががたつかず，両者の位置決め程度とする。以上により，図３（ａ）に示す，組付体１０を得る。

【００４７】次に，図４（ａ）に示すごとく，上記組付体１０を２つ，絞り加工機４にセットする。ここに，上記絞り加工機４につき説明する。上記絞り加工機４は，絞り加工用金型４１と押出機４２とよりなり，上記絞り加工用金型４１は，図４（ａ），図５に示すごとく，テーパ部４１１を設けたキャビティ４１０を有する。上記テーパ部４１１のテーパ角αは約５°である。なお，図４において，符号４２１は押圧板，符号４２２は空気室である。

【００４８】そして，図４（ａ）に示すごとく，上記絞り加工用金型４１内のキャビティ４１０内に押出機４２のピストン４２０を動かし，上記組付体１０を押し出す。図４（ｂ），図５に示すごとく，上記組付体１０は，上記キャビティ４１０のテーパ部４１１を通過する際，その外径が縮径され，セラミック製触媒担体１２の径はそのままで，上記外筒１３の厚み，上記保持材１１の厚みが縮小される。

【００４９】その後，後続の組付体１０とピストン４２０により，外筒１３の縮径の済んだ組付体１８が，上記絞り加工用金型４１より押し出される。以上により，図３（ａ）に示す組付体１０が，図３（ｂ）に示すごとき，縮径された組付体１８となる。次いで，上記組付体１０の後のキャビティ４１０内には，図４（ｂ）に示すごとく，次の組付体１０が挿入されて，同様に，連続的に上記絞り加工が行われる。

【００５０】その後，上記縮径の済んだ組付体１８の両端に対し，図１に示すごとく，フランジ１５１，１５２を嵌め込み，溶接する。なお，上記フランジ１５１，１５２は，フランジ１５１，１５２と外筒１３との間の排気ガス洩れを防ぐために，両者の間は全周接合されている。以上により，本例にかかるセラミック触媒コンバータ１を得る。

【００５１】次に，図６に示すごとく，本例のセラミック触媒コンバータ１は，自動車用エンジン２５の排気経路中に設置されている。上記セラミック触媒コンバータ１は，エキゾストマニホルド２６１，２６２の取付フランジ２４１とスタートキャタリスト２１の取付フランジ２４２との間に，図示されていないガスケットを介し，

ボルトにより連結固定される。上記エンジン２５は排気量４０００ｃｃであり，該エンジン２５より導出される８本のマニホルド２６は，４本ずつ集合し，２本のエキゾストマニホルド２６１，２６２となる。

【００５２】そして，上記エキゾストマニホルド２６１，２６２において，それぞれセラミック触媒コンバータ１が，さらにその下流に１３００ｃｃの容量を有するスタートキャタリスト２１がそれぞれ配置されている。なお，上記セラミック触媒コンバータ１は，エキゾストマニホルド２６１，２６２の直下に配置されている。

【００５３】上記スタートキャタリスト２１は，スタートキャタリスト用の外筒２１１内にワイヤネットあるいはセラミックファイバマットを介して保持固定されてある。上記外筒２１１の下流側フランジ２４３は，排気管２２１，２２２に設けたフランジ２４４に対し，連結固定されてある。

【００５４】また，上記排気管２２１，２２２は，上記スタートキャタリスト２１よりも更に下流側において合流し，図示しない１０００ｃｃのキャタリストに接続されている。上記の構成にて，エンジン２５を始動することにより，本例のセラミック触媒コンバータ１は，始動より約１０～１５秒後（エンジンはアイドリング状態）には，エンジン２５より排出される排気ガスからの熱により，４００℃～５００℃に昇温される。これにより，セラミック製触媒担体１２に担持された触媒層が活性化され，排気ガスの浄化が行われる。

【００５５】次に，本例における作用効果につき説明する。本例にかかるセラミック触媒コンバータ１の製造方法においては，保持材１１を装着したセラミック製触媒担体１２を外筒１３に挿入した組付体１０は，上記保持材１１が所定の面圧を有するようになるまで，外筒１３をテーパ状変形させて全周縮径する。このため，上記保持材１１には，圧縮過剰となる部分も，圧縮不足となる部分も発生せず，外筒１３の全周において均一な面圧を発生することができる。

【００５６】また，上記保持材１１は，外筒１３のテーパ状変形を経て，上記保持材１１が所定の面圧を有するまで全周縮径される。このため，保持材１１を構成する繊維には破損が発生せず，従って，セラミック製触媒担体１２を安定かつ確実に外筒１３内に組付けることができる。

【００５７】更に，図４，図５に示すごとく，上記縮径の際のテーパ角αは５°と小さいため，保持材１１を構成する繊維が曲げ破断することなく，所定の保持面圧を発生するまで縮径することができる。また，テーパ角αは５°と小さいため，外筒１３の絞り加工用金型４１からの押出時において，上記テーパ部４１１における反力を小さくすることができ，この工程を容易とすることができる。

【００５８】なお，上記外筒１３の厚みは１．５ｍｍであるため，縮径工程が容易であり，かつ縮径時に該外筒１３に割れが生じない。以上により，本例によれば，その製造の際に保持材１１を構成する繊維の損傷がなく，かつ常にセラミック製触媒担体１２が安定かつ確実に保持されているセラミック触媒コンバータ１を提供することができる。

【００５９】また，上記保持材１１は上述したごときアルミナ繊維により構成されている。上記アルミナ繊維は，温度が１８００℃を越えなくては相変態しない安定した物質である。しかも，上記保持材１１には，上記アルミナ繊維より耐熱性が劣るバーミキュライト，マイカ等の熱膨張物質は一切含まれていない。

【００６０】このため，エンジン２５から排出される排気ガスにより加熱された程度では，上記アルミナ繊維は，体積が減少したり，面圧が低下することにより，セラミック製触媒担体１２を保持できなくなるということはない。従って，高温雰囲気においてもセラミック製触媒担体１２の保持を長期に渡って安定させることができる。

【００６１】また，本例の製造方法においては，バインダで成形した保持材１１をセラミック製触媒担体１２に設け，その後，これらを外筒１３内に挿入する。このため，これら三者間の位置決めが容易である。また，上記保持材１１は組付前にバインダにて圧縮成形されているため，取り扱いやすく，また，圧縮成形の分だけ外筒１３の縮径量をより小さくすることができる。また，バインダにより，上記外筒１３に保持材１１を装着したセラミック製触媒担体１２を挿入する際に保持材１１を保護することができる。さらに，上記保持材１１は，上記セラミック製触媒担体１２と上記外筒１３との空間形状と略同形状の円筒形状を有しているため，組み付けも容易である。

【００６２】また，上記外筒１３に保持材１１を装着したセラミック製触媒担体１２を挿入する場合の挿入代は直径３ｍｍであり，また挿入前の保持材１１のかさ密度も０．１２ｇ／ｃｍ³と小さい。このため，上記挿入の際に保持材１１の繊維が破損することもない。

【００６３】また，上記セラミック触媒コンバータ１は，エキゾストマニホルド２６１，２６２の直下に配置されており，特に，従来の床下に配置される触媒コンバータと比較し，排気ガスの持つエネルギーを多く受け取ることができる。そして，上記セラミック製触媒担体１２は，薄壁のモノリスより構成されているため，比較的熱容量が小さい。以上の理由により，本例のセラミック触媒コンバータ１は，エンジンの始動後，短時間で昇温し，触媒を活性化状態とすることができる。つまり，エンジン始動直後における高い排気浄化率を有する。

【００６４】また，本例のセラミック触媒コンバータ１を製造する際には，上記外筒１３の縮径は，テーパ部４１１を有する絞り加工用金型４１を使用した絞り加工機

11　　12

４を用いて行う。この絞り加工機４は構造が簡単であり，製造コストを安価とすることができる。また，上記絞り加工機４を用いた絞り加工は，その押出工程において，前方の組付体は後続する他の組付体により押し出される。これにより，連続的かつ効率良く絞り加工を行うことができる。

【００６５】実施形態例２また，本例は，実施形態例１と同様の製造方法により製造されたセラミック触媒コンバータ１で，その外筒１３の外側に更に別部材の最外筒１９を配置し，二重管構造としたセラミック触媒コンバータである。

【００６６】上記セラミック触媒コンバータ１の製造に当っては，実施形態例１と同様の絞り加工により縮径した組付体１８（図３（ｂ））の外径に対し，その内径が略０．５ｍｍ大きい最外筒１９を組付け，例えば２ヶ所レーザ溶接により全周接合する。なお，同図において１９０は溶接痕である。その他は実施形態例１と同様である。

【００６７】本例にかかるセラミック製触媒担体１は，最外筒１９を設けてなるため，縮径される外筒１３を薄肉（例えば板厚１．０ｍｍ）とすることができる。これにより外筒１３の縮径が容易となり，かつセラミック触媒コンバータ１としての強度は最外筒１９が維持することができる。従って，本例によれば，縮径が容易である共に耐久性の高いセラミック触媒コンバータ１を得ること＊とができる。

【図面の簡単な説明】

【図１】実施形態例１における，セラミック触媒コンバータの断面説明図。

【図２】実施形態例１における，セラミック触媒コンバータの組付け説明図。

【図３】実施形態例１における，図２に続く，セラミック触媒コンバータの組付け説明図。

【図４】実施形態例１における，組付体に対する絞り加工の説明図。

【図５】実施形態例１における，縮径途中の組付体の部分断面説明図。

【図６】実施形態例１における，自動車用エンジンの排気経路中における，セラミック触媒コンバータの配置説明図。

【図７】実施形態例２における，最外筒を設けたセラミック触媒コンバータの説明図。

【符号の説明】

１．．．セラミック触媒コンバータ，

１０，１８．．．組付体，

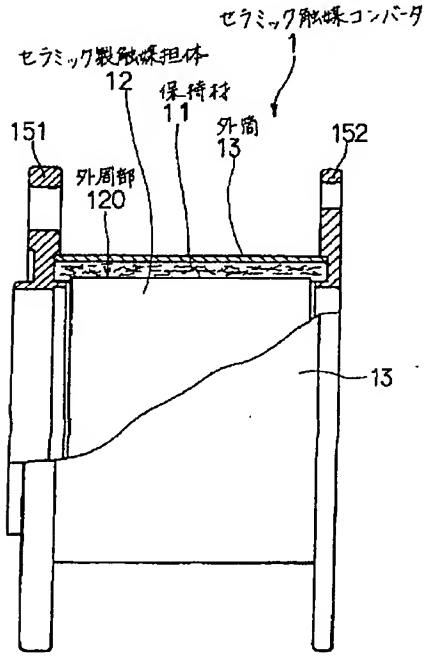
１１．．．保持材，

１２．．．セラミック製触媒担体，

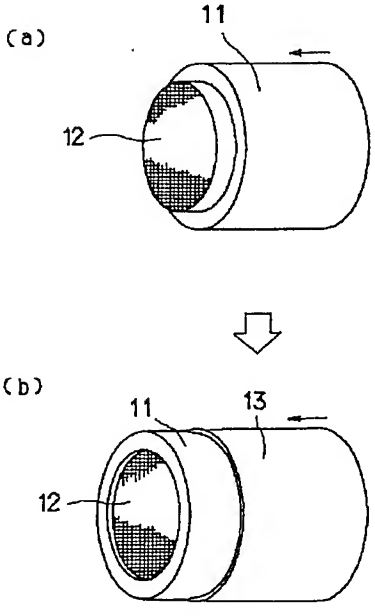
１３．．．外筒，

１９．．．最外筒，

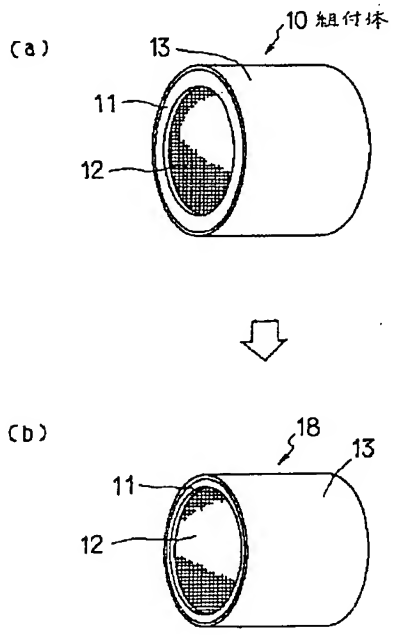
【図１】



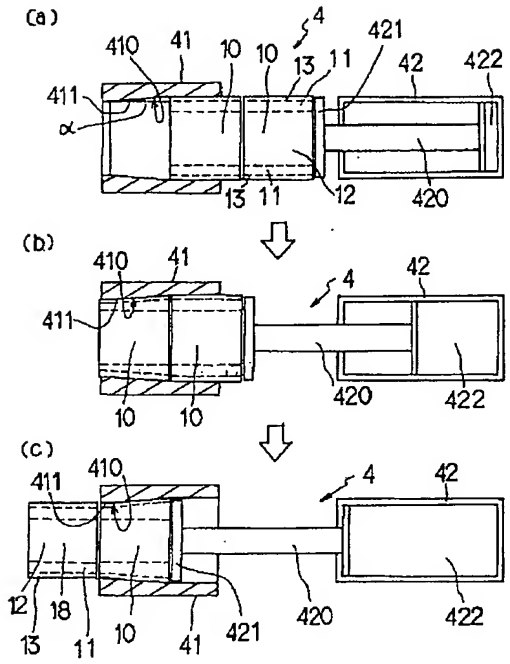
【図２】



【図３】



【図４】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11
4
421
42
422
411
α
13
11
12
420
(b)
410
41
4
42
411
10
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420
422
(c)
411
410
4
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12
18
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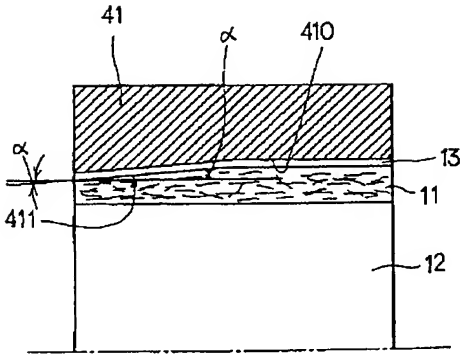
422

【図５】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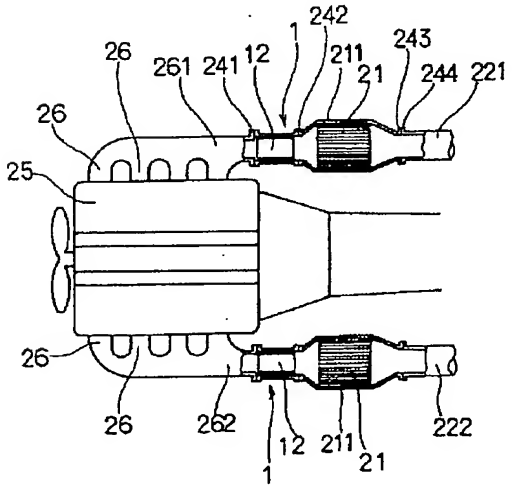
【図６】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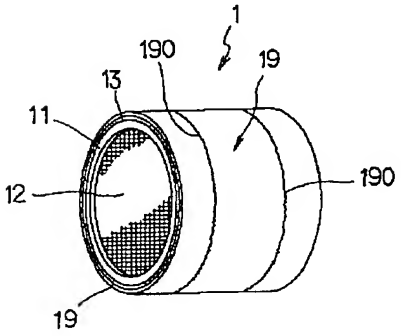
【図７】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